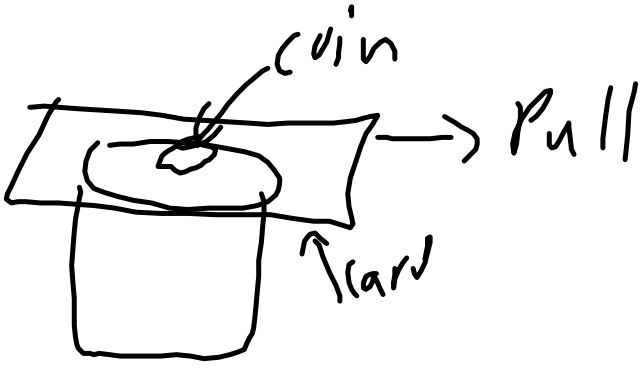
Happy Halloween!

Intro to Forces, Chapter 5
hand back acceleration test (short answer)
corrections for homework
go over the whole test next class

3 demonstrations:
1. coin on a card
2. ball in circle
3. cart with spring loaded ball

Predict what will happen when:
1. I pull the card with a coin on top



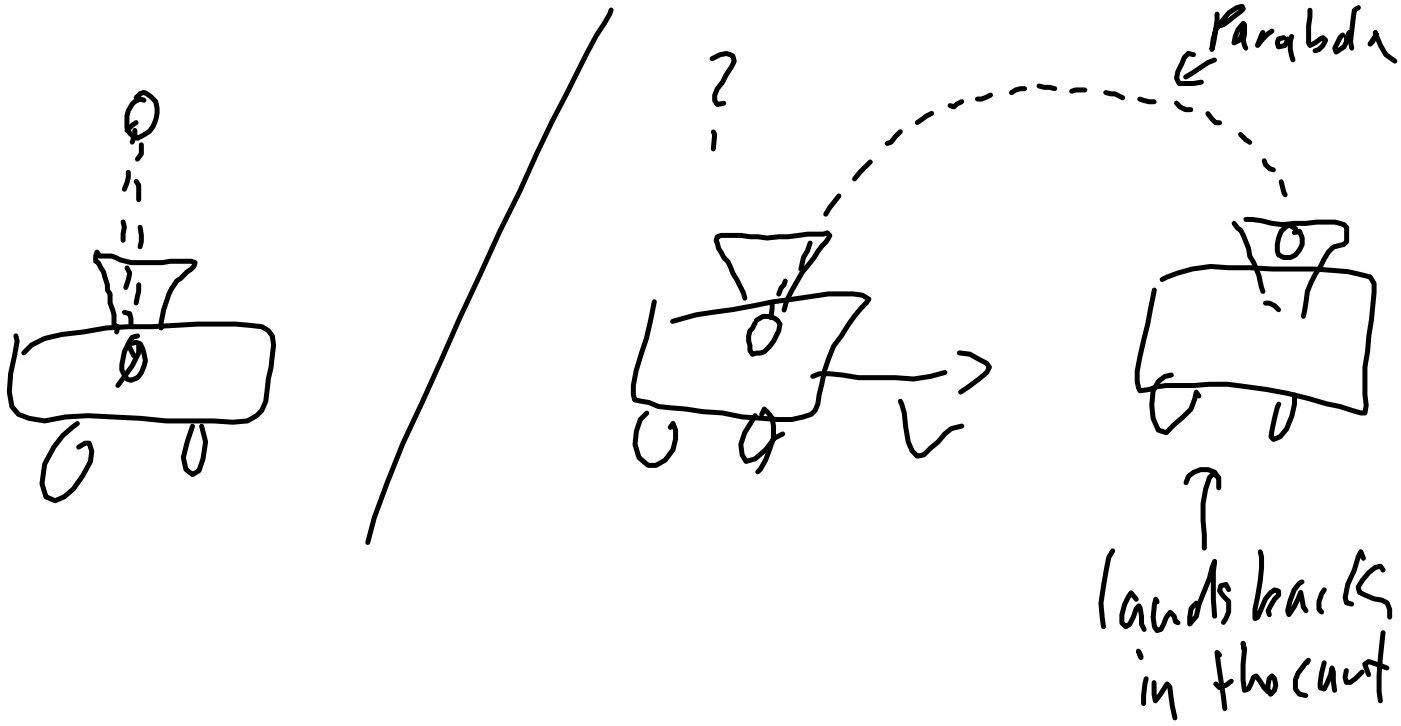
Fast: coin falls
Slow: coin moves

2. Marble rolling in a circular path. What happens when I lift the tubing?

Result: 3, the ball goes in a straight line

Result: 3, the ball goes in a straight line if the tubing doesn't push it

3. A cart that fires a marble straight up. What is the path of the marble if the cart is rolling?

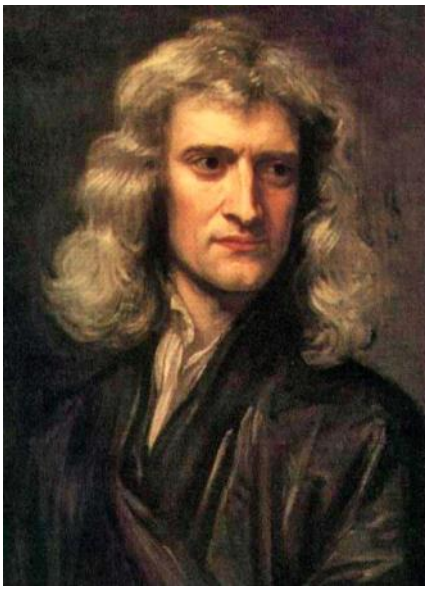


What is the common feature of the three demonstrations?

The coin or the ball tends to stay at rest or stay in constant speed, constant direction motion.

We call the tendency: Inertia
(not a force)

Newton's Three Laws of Motion:



1643-1727
(also known for inventing calculus, developing gravitational theory, optics)

Newton's First Law - Law of inertia
Object at rest, stays at rest - objects in motion stay in linear constant speed motion unless they experience unbalanced forces.

Force is a push or a pull. Measured in units of Newtons, N. The force of gravity on a 100g apple, is about 1 Newton.

Force is a vector quantity - magnitude and direction.

Net force, F_{net} is the vector sum of all forces.

$F_{net} = \sum F$

eg. I push the cart to the right with 3.0 N of force, you push to the left with 4.0 N of force, what is the net force?

3.0N-4.0N = -1.0N
or 1.0N left
What happens if the net force is not zero?
The motion changes. How does it change?

Newton's Second Law - Law of acceleration
Objects accelerate proportionally to the net force on the object and inversely to the mass of the object.
$a=F_{net}/m$

more commonly we write this as:
$F_{net}=ma$

You see that the units of force, Newton must be equivalent to units of mass and acceleration:
$N=kg \times m/s^2$

eg. I push a 2.0 kg cart with 4.0 N of force. What is the acceleration of the cart if

a) there is no friction?
b) the force of friction is 0.50 N?
c) I add another 1.0 kg mass on the cart that increases the friction to 1.0N.

Homework: p92 Q1-4, p93 CR 1.1-1.4
corrections to the short answer questions on the test.
eg. I push a 2.0 kg cart with 4.0 N of force. What is the acceleration of the cart if

a) there is no friction?

the only force is the applied force, so the net force is 4.0N

$a=F_{net}/m = 4.0N/2.0kg = 2.0m/s^2$

b) the force of friction is 0.50 N?

$F_{net} = 4.0N - 0.50N = 3.5N$

$a=F_{net}/m = 3.5N/2.0kg = 1.8m/s^2$

c) I add another 1.0 kg mass on the cart that increases the friction to 1.0N.

$F_{net} = 4.0N - 1.0N = 3.0N$

$a=F_{net}/m = 3.0N/3.0kg = 1.0m/s^2$